Laboratory Investigation Of A Multiple-Model State Estimation Scheme For Detection And Isolation Of Leaks In Pipelines

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Summary

A pipeline system is an essential component in the transport of natural gases, crude and oil products in the petroleum industry, as well as gas and water in vital utility systems. Early detection of leaks in pipelines is essential to avoid excessive economical loss and reducing the environmental and health hazards that normally result from undetected leaks. In this paper, a model-based estimation scheme, which was developed as a basis for real-time monitoring of fluid flow in pipelines, is tested experimentally. In this estimation scheme, the fluid flow in a pipeline, which is modelled by a set of non-linear partial differential equations, is represented in a state-space form. A modified extended Kalman filter (MEKF), with its internal model defined by the obtained state-space form, is invoked together with feedforward computations to establish an adaptive multimodel state estimation technique. A laboratory experimental test-rig is constructed to test the validity and effectiveness of the developed leak detection and localization scheme. Experimental results utilizing the laboratory set-up are presented to demonstrate that the developed scheme effectively detects and locates leaks in pipelines within a short time duration.

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